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Research Article

Conversion Process of OxTube Water Clarification

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Abstract

Water is a pure substance that picks and carries a huge load during its natural cycle on the earth, in the bio systems, in washing and cleaning, in medical care as well as in agricultural an industrial processes. Wastewater flows underground to the concentrated treatment plants, and further, it flows in natural waters out of our sights. Rainwater is led as fast as possible via the huge underground sewer network in the natural waters as well. Waste is carried out from cities and piled on the landfills at country side. The smell becomes nauseating and birds appear in droves. Many cases the city snow is dumped into seas. The natural waters and eco systems suffer increasing amount of toxins, drug and pharmaceutical residues, nutrients, various poisons, many other chemicals, micro plastics, resistive microbe growth, unbalanced algae, and large areas of zero oxygen. In spite of this a huge amount of evaporation cool is lost. It's urgent to refresh waters and food chains as well as to improve waste water treatment so that it can be sprayed on ground, plants as well as on all kinds of heat sources like photo voltaic panels, data centers, factories and city roofs [1].

OxTube, a new water treatment innovation clarifies water matrices in tube condition with nature respect within seconds by four seamless phases; (1) separation of dissolved substances, (2) activation of molecules, (3) clarification and (4) post dissolving and refreshing. It separates and removes dissolved gases like radon, carbon dioxide, hydrogen sulfide and hydrocarbon, and dissolved solids like iron, manganese compounds, calcium, fluorine and phosphorus in hermetic tube condition. Removal of drug and pharmaceutical residues, and disinfection in one together with clarification is verified by ozone feed. OxTube water clarification can be combined with any other water system in practice which means a huge saving potential.

The clarified wastewater should be discharged in to nature with full nature respect. The proper way treated wastewater can be led to the natural water cycle by spraying it on ground, landfills, plants, roofs and all kinds of heat sources for the evaporation and climate cooling by solar and process heat. The destructive load can be reduced in seas and oceans. Conversion process of OxTube Water Clarification combined with fountain is discussed here briefly.

Keywords: Water clarification, Water purification, Water treatment, Water recycling, Combined water clarification, Wastewater discharge, Climate cooling

Introduction

Hybrid and decentralized waste water treatment should be carefully considered instead of centralized one with good reason [2]. Today wastewaters with their load are pumped thousands kilometers to the centralized treatment plants and further, poorly processed in the waters through the huge underground sewer network as illustrated in Figure 1 [3,4]. Rainwater is led through various ways mostly underground in the waters, too. Climate cooling by water evaporation is reduced significantly, and the sewer network causes serious floods [3]. Water and ingredients recycling is little. Many serious problems, disasters, awful smell and serious unbalanced and resistive microbe growth can be avoided by the water clarification and wide area water buffers with solar evaporation. The combined water clarification integrated in the natural water cycle is necessary for the bio systems and food chains as well as for the climate balance [4,1,5]. The combined water clarification and fountain is an efficient natural water refreshing as well as a combined wastewater discharge and bio gas collection practice at landfills.

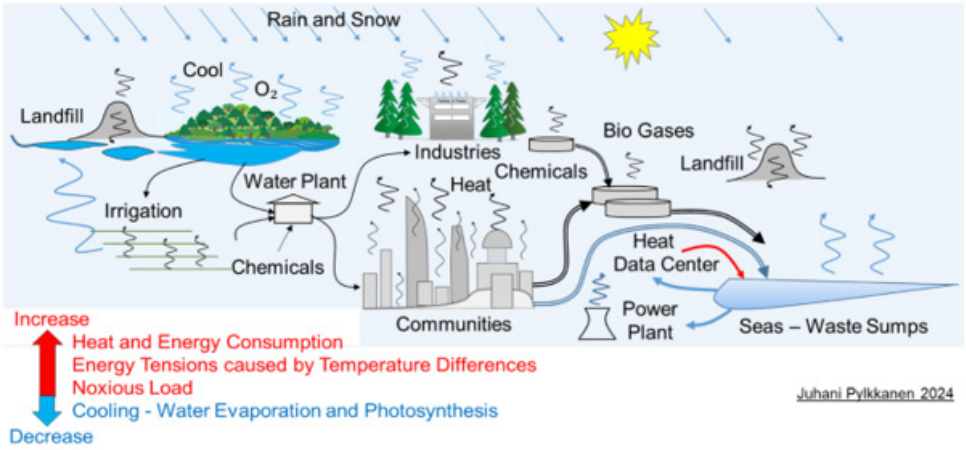

Figure 1: Growing Civilization and Unnatural Water Cycle. Heat sources can be switched to climate coolers by proper waste water treatment and water buffering with wide area evaporation and photosynthesis [1,5].

Water is a pure substance that carries a huge load during its natural cycle on the earth, in the bio systems, in washing and cleaning, in medical care as well as in agricultural an industrial processes. Water gets rid of the load by evaporation caused by solar heat, and leaves it in the ponds, lakes and seas. The waters and eco systems suffer increasing amount of toxins, drug and pharmaceutical residues, nutrients, various poisons, many other chemicals, micro plastics, and unbalanced microbe growth, algae and large area zero oxygen. The natural water cycle functions as a major climate cooling element together with the photosynthesis powered by the sun. A lot of evaporation cool has lost by extension of civilization, open area building and construction, and underground sewerage systems. The civilization heat sources can be turned to climate cooling by the proper wastewater treatment and buffering, large area water evaporation and photosynthesis [1,5]. Just giving an example, low efficient photo voltaic panels could be cooled and their efficiency enhanced by evaporation of clarified wastewater on panel surfaces, so electricity can be generated and the climate cooled at the same [5].

Conversion of OxTube Water Clarification in Brief

The OxTube water clarification in tube condition consists of four seamless treatment phases and as the fifth step a firm gas bubble generation in the flow as follows:

a) Separation of dissolved substances

b) Activation of molecules

c) Immediate clarification reactions

d) Replacement dissolving

e) Bubble generation in water flow for combined flotation and clarification

Conversion process of OxTube is illustrated in Figure 2. Separation of dissolved substances and molecular activation are performed in the DuOx Nozzel just before the gas suction or feed. Desirable clarification reactions are initiated immediately after the cyclone eye caused by the split water flow. The gas like air is fed in the cyclone eye by suction. The air flow in to the water by the free suction could be over ten times of water in volume. So, the mass flow and flow speed increase respectively, and density of the air-water mixture reduces respectively, too. Amount of gas and bubbles can be managed simply by valve control. However, particles start to attach on bubbles already in OxTube and the following tubes by flotation that is beneficial in the flotation systems [6]. Further, viscosity of the air water mixture is much lower than water has, and dynamic pressure increases by the factor of flow speed to the power of two. This results high conversion efficiency and low losses by means of mass flow. Figure 3 illustrates the conversion by a practical test [4]. The air-water mixture is coherent and the spray height increases 9 times from plain water spray. Bubbles mixed in water are used for reduction of water resistance e.g. in ship cruising [7].

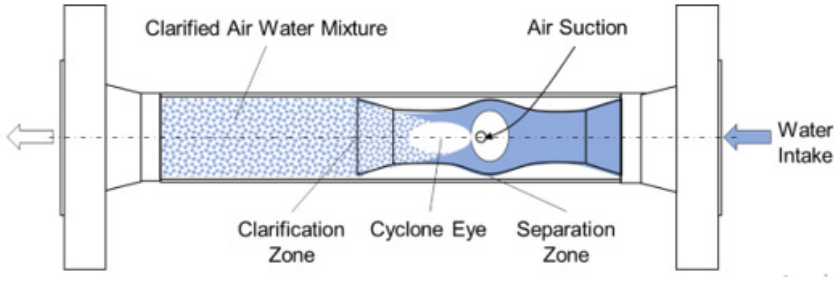

Figure 2: Conversion Process of OxTube Water Clarification in Tube Condition.

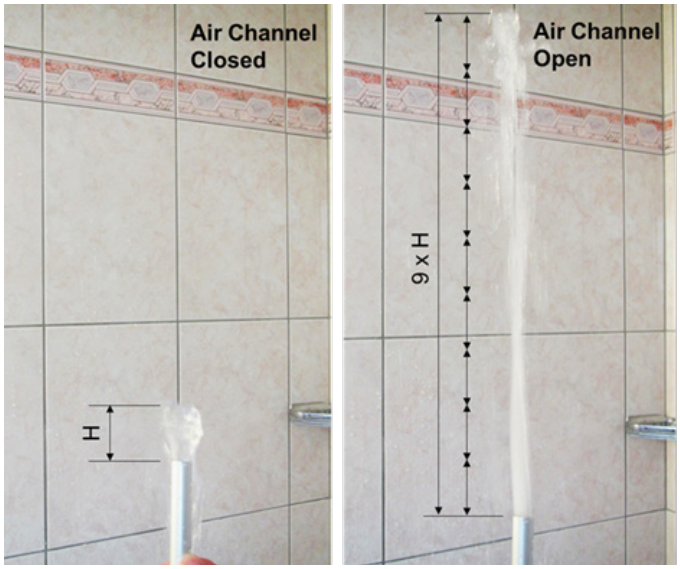

Figure 3: Height of the mixture is nine times higher than the plain water has in the exact same condition of water intake. Air suction could be over 10 times of water in volume at NP [4].

Dynamic Pressure is described by the formula

$q = ½ * \varrho * v^2$

where ϱ is the fluid density and v the fluid velocity.

Kinetic energy is described as follows:

$Ek = ½ * m*v^2 = ½*\varrho*V*v^2$

where m is mass that moves by velocity of v, and ϱ is density and V volume.

Viscosity is related to the liquid resistance in flowing condition. The resistance influences between liquid layers. Viscosities η of air and water are as follows:

i. **Air:** viscosity $\eta = 17.4*10^{-6}$ Pa*s

ii. **Water intake:** viscosity $\eta = 1.002*10^{-3}$ Pa*s

Regarding the losses, turbulences and clarification efficiency the optimal flow speed of the water in the intake tube is v = 2 m/s which results dynamic pressure q = 2 N/m^2. When the mixture of air-water is in ratio of 10 to 1, tube size of OxTube is equal to water intake and back pressure 1 bar, the conversion is described by main numbers as follows:

i. Viscosity of the mixture $\eta = 0{,}093*10^{-3}$ Pa*s

ii. Flow speed of the mixture v = 22 m/s

iii. Density of the mixture ϱ = 0.1 of water

iv. Dynamic pressure q = 48.4 N/m^2

v. Spray head of OxTube400 H = 24 m

vi. Axial force of OT400 without air suction; $F_{a0} = \pi*r^2*q = \pi*0.0212^2*2$ N = $1.28*10^{-3}$ N

vii. Axial force of OT400 with air suction; $F_a = \pi*r^2*q = \pi*0.0212^2*48.4$ N = $6.83*10^{-2}$ N

The spray height increases from 0.2m to 24m and the flow speed from 2 to 22 m/s just by the conversion from water to air-

water mixture in ratio of 10 to 1 are verified by the tests. Normal fountain nozzles are formed for high spray functions that means high pumping power as well.

OxTube clarifies various water matrices by nature respect [3,4]. It separates and removes dissolved gases like radon, carbon dioxide, hydrogen sulfide and hydrocarbon, and dissolved solids like iron, manganese compounds, calcium, fluorine and phosphorus in hermetic tube condition. Removal of drug and pharmaceutical residues, and disinfection in one together with clarification are verified by ozone feed. OxTube water clarification can be combined with any other water system in practice which means a huge saving potential [8]. OxTube Machine and its functions are summarized in Figure 4 [5].

Figure 4: OxTube Machine and its functions in one [5].

Figure 5 shows one example of wastewater clarification cases by OxTube Machine [9]. Turbidity of 0.0 NTU and zero smell were achieved just by one run through the OxTube and retention of 30 minutes [10].

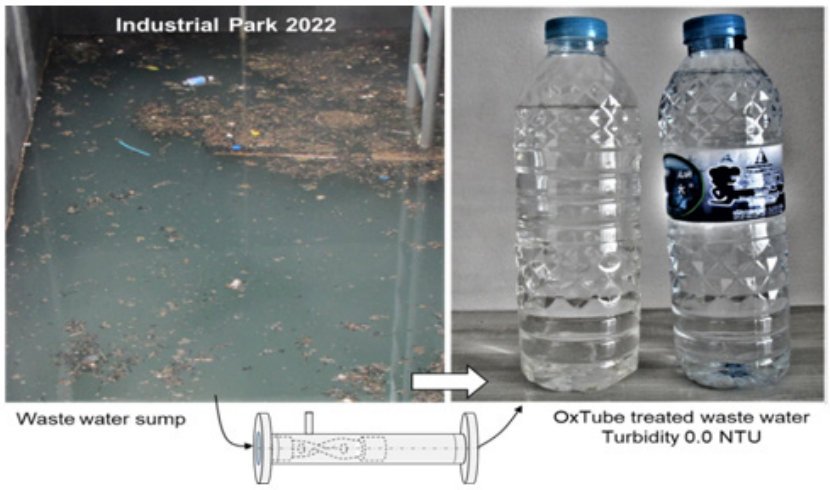

Figure 5: OxTube test runs of an industrial waste water resulted turbidity of 0.0 NTU and zero smell. The clarified water is recyclable in industrial process use [9]. The waste water is clarified and aerated, and with ozone feed the water is disinfected, too.

Combined Water Clarification and Fountain

OxTube conversion process is suitable for combined water clarification and fountain. It provides a high spray of the coherent air-water mixture as described in Section 2. The fountains are common in the waters of urban areas where the natural water clarification is the most needed. The power consumption is reduced significantly by OxTube Conversion together with the integrated clarification compared to the present fountains without clarification function at all. Condition of water and food chains is identified to improve by the combined water clarification and fountain as illustrated in Figure 6. Fishes, grey fishes and mussels are found to grow bigger and became clearer than before.

The combined wastewater clarification and fountain spray can be utilized in landfills as well as many similar sites. Today the city waste is carried onto landfills on country side nature. The landfills generate a lot of bio gases and awful smell far away from our sights. Only a little of the bio gases are collected and utilized worldwide. OxTube conversation can be used for improvement of bio gas collection and discharge of clarified wastewater. The OxTube Fountain Spray can form a bio gas and smell trap as illustrated in Figure 7. Birds can be kept out of the landfills, and many epidemics are eliminated.

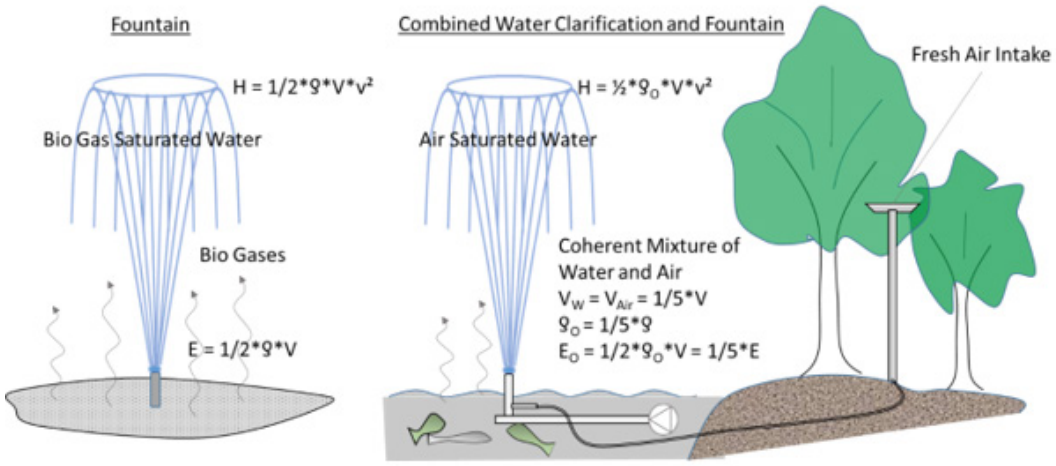

Figure 6: Combined Water Clarification and Fountain saves energy 1/5 or more compared to regular fountains.

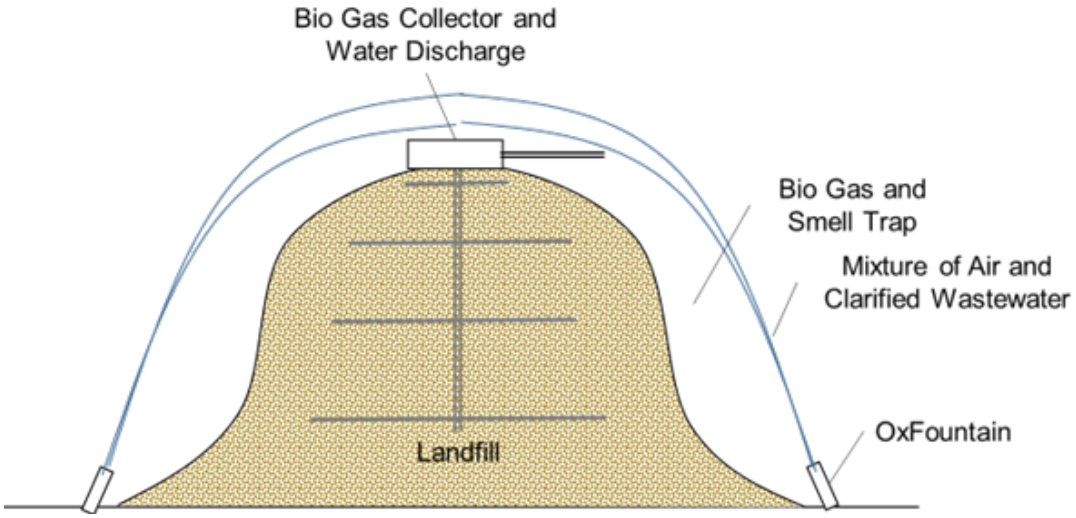

Figure 7: Combined Water Clarification, Landfill and Bio Gas Collection. The water spray eliminates leakage of bio gas to air and keeps birds out of the landfill. Proper way clarified wastewater is used. Power consumption could be 1/5 of a present fountains of the same spray head.

Summary

OxTube Water Clarification in tube condition has been applied successfully in removal of pharmaceutical residues, radon gas, calcium, manganese and iron from various water matrices, and in disinfection of wastewaters with ozone. Oxygenation of the wastewater is executed at the same time. Microbe and variant growth is reduced with just clean air suction, and eliminated with ozone feed.

Hybrid and decentralized waste water treatment should be carefully considered instead of centralized one with good reason [2]. In principle the wastewater can be clarified by OxTube in sewage drain on the way back to the nature. However, it's definitely a better way to clarify wastewater combined with other water systems promoting recycling and evaporation cooling.

OxTube Machine is easy to be integrated in and combined with present water systems. The DuOx nozzle can be integrated in hydro turbines combined with power generation and water clarification. Combined fountain and water clarification by integration of OxTube reduces energy consumption in to one fifth or even more.

Acknowledgement

None.

Conflict of Interest

None.

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